

USING SCIENCE VOCABULARY INDEX CARDS
TO PROMOTE ACADEMIC SPANISH USAGE

by

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ABSTRACT

This study, in a dual language setting, focused on improving fifth-grade students' academic Spanish in a science classroom. Bilingual education too often focuses on the gains made in English. In bilingual education research, gains made in the second language, like Spanish, are not often documented. This study looked at how the creation and implementation of study techniques that would help improve academic Spanish. Students made and studied 20 vocabulary index cards with science terms in Spanish. The words came from the content being studied during a four week science curriculum. Through pre- and posttest scores on a vocabulary test, a rubric to grade the notecards, and video recordings of students studying with different techniques, the following findings were discovered: All students improved in their vocabulary from the pretest to the posttest, female students showed greater gains and higher scores on the vocabulary index cards, and students with the least gains in acquired vocabulary had similar needs that made learning independently more difficult and would have been served with more teacher support. All students would benefit from practice using different study strategies with the vocabulary index cards.

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TABLE OF CONTENTS

ABSTRACT	iii
ACKNOWLEDGMENTS	iv
CHAPTER 1—PROBLEM STATEMENT AND LITERATURE REVIEW	1
Problem Statement	1
Review of the Literature.....	2
How Much Spanish Is Spoken in the Classroom?.....	3
School and Community Support for Bilingual Education.....	7
Family Funds of Knowledge and Capital	8
Support for Bilingual Education.....	9
Bilingual Education: Does It Work?	10
How Should Spanish Be Taught?	12
Building Vocabulary for ELLs and Academic Language	13
Vocabulary Index Cards and Building Science Vocabulary	15
Development of the Research Question	17
CHAPTER 2—METHODS, CLASSROOM CONTEXT, PRACTICE DESCRIBED, DATA COLLECTION, AND LIMITATIONS	19
Student Demographics, Language Usage, and Science Classroom	19
Vocabulary Index Cards in Action.....	20
Data Collection.....	21
Receptive Vocabulary Pre- and Posttest.....	22
Vocabulary Index Cards	23
Video Recording.....	24
Quality Indicators and Limitations of the Study	25
CHAPTER 3—FINDINGS AND IMPLICATIONS	28
Finding One: All Students Vocabulary Usage Improved	28

Home Language Effect on Spanish Language Usage	30
Vocabulary Index Cards: Just one Form of Vocabulary Exposure	31
Finding Two: High Test and Rubric Scores and Academic Spanish Usage:	
Mostly Females	33
Water Cycle Poster Presenters.....	33
Early Finishers: Filmed Studying.....	34
Early Finishers: Vocabulary Usage Success	37
Vocabulary Cards Study Techniques	38
Video Analysis of Students Studying.....	39
Pretest to Posttest: Girls vs Boys.....	41
Vocabulary Index Cards: Notes and Scores	42
Finding Three: Similarities between Five Students with the Least Gains	
Student by Student Description.....	47
Implications and Future Practice	49
Conclusion	50
REFERENCES	52
APPENDICES	
A. Vocabulary Terms and Definitions in Spanish	56
B. Grading Rubric for Science Vocabulary Index Cards	57

CHAPTER 1—PROBLEM STATEMENT AND LITERATURE REVIEW

Problem Statement

City Elementary school is a Dual Language Enrichment Program serving students from Kindergarten to fifth grade. For a school to be considered a dual language immersion program, also referred to as a two-way bilingual immersion program, “instruction must be presented through the non-English language (e.g. Spanish, Korean) for at least 50% and up to 90% of the instructional day” (Lindholm-Leary, 2007, p. 2). City Elementary follows the 50/50 model. According to the Office of Superintendent of Public Instruction (OSPI) Washington State Report Card Website, City Elementary’s building houses 497 students, 90% of whom receive free or reduced lunch. The student population consists of 77% Hispanic, 20% White, and one percent for other ethnicities. At the school there is an approximately equal number of boys and girls (Washington State Report Card, 2015). The racial demographics and languages spoken set the school apart from the other elementary schools in the district.

At City Elementary, the students receive instruction in English and Spanish throughout all grades. Half of the students’ day takes place in English where they learn mathematics and English language arts, while the other half of the day provides the students with science and reading and writing in Spanish. Social studies is taught in English and Spanish, but due to the available material in English more instruction is done in English than Spanish. Specialist classes like art, library, music, and P.E. are taught by teachers who only work in English. For these reasons, students at City Elementary receive more instruction in English, but the expectation, for students, remains to be proficient in both English and Spanish.

Despite this desire of proficiency in both languages, the reality persists that as students progress into the upper elementary grades, English begins to dominate and Spanish production loses importance. A study conducted by Potowski (2004) reported that fifth-grade students in a bilingual school used Spanish 56% of the time during the Spanish class, yet they did not use Spanish during the observations from the English class. Potowski's study shows that students use English 44% of the time in a class where they are supposed to be working in Spanish. This is troubling considering virtually no Spanish was used in the fifth-grade English class. Potowski cited a number of studies that confirm this trend. She stated that, "Broner (2000), Carrigo (2000), and Fortune (2001) have quantified immersion students' language use and confirmed that less Spanish was used than educators might expect" (p. 76). Unfortunately, this trend might be happening at City Elementary School. In the fifth-grade classrooms, students also communicate in English with each other during Spanish time. Further, it seems that students' vocabulary usage has greater variety in English than in Spanish. Seventy-seven percent of City Elementary students are Hispanic (Washington State Report Card, 2015) and have opportunities to speak in Spanish in the home and parts of the community. Therefore, learning more Spanish vocabulary, including academic Spanish, would be a way of valuing and maintaining the Spanish that was originally the first language of most of the school's students.

Review of the Literature

An important feature of a dual language or bilingual education program is that the second language (Spanish) needs to be taught in at least 50% of the curriculum. Christian's (1996) research indicates that two-language learning is best supported when

the classroom has a balance of English and Spanish speaking students. Even though most bilingual schools provide instruction equally in both languages, most studies conducted about bilingual and dual-language education focus on student achievement gains on English benchmark or standardized tests (Cummins, 1999; Alanis & Rodriguez, 2008; and Rolstad, Mahoney, & Glass, 2005). By focusing on English gains, it helped to show opponents of bilingual education the importance of such an education. However, little attention is given to the language that is not English, which in most cases is Spanish. Often Spanish speaking students in a bilingual program are merely labeled as Spanish “proficient” (Potowski, 2004). While the home language of the majority of dual-language program students is Spanish, a stronger emphasis is placed on English, causing teachers and students to make a shift towards using more English, and in the case of City Elementary, less Spanish. Simply put, in many dual-language schools, English is valued more and Spanish is valued less. Students of bilingual education deserve to have high-quality education in both languages. Helping students go beyond Spanish ‘proficiency’ places value on the home language spoken by the majority of students in bilingual education.

How Much Spanish Is Spoken in the Classroom?

Finding out how much English and Spanish are actually being used in the classroom is a good place to start when considering the need to increase Spanish usage. The problem is the lack of research studies that actually focus on the Spanish aspect of dual-language programs. Having high test scores in English justifies the existence of dual-language programs (Krashen & McField, 2005; Rolstad, Mahoney, & Glass, 2005; Alanis & Rodriguez, 2008). As Cummins (2005) stated, “The majority or dominant

language [English] is usually the language associated with power and status in the society and thus it is not surprising that children's achievement in that language should be of concern to parents and policy-makers" (p. 3). But Spanish-language learning needs to be documented and strategies to increase Spanish proficiency need to be explored. Some researchers have looked at Spanish production and usage in bilingual education (Carrigo, 2000; Lagarreta, 1997; Pease-Alvarez & Winsler, 1994; & Potowski, 2004).

Of the limited number of studies that have quantified data based on Spanish usage in dual-language settings, the results vary significantly. Pease-Alvarez and Winsler (1994) looked at three fourth-grade students' Spanish usage throughout the school day including time spent in the classroom. Because the study followed only three students over a period of 14 months, the transferability of the findings to a different context is lowered. But, the length of time spent following the students makes the study highly credible. The English classroom was treated as an exit out of dual-language within a dual language immersion school. In the school, students received instruction in Spanish and English from Kindergarten through third grade and were transitioned into English-only classrooms during fourth and fifth grades. The fourth-grade teacher featured in this study was very open and willing to have Spanish spoken in his "English only" classroom as he felt it was important that students understood instruction. This study showed that the teacher valued his students' ability to speak two languages, which included his recognition of bilingual students' ability to secure future employment (p. 511).

The value placed on Spanish by the teacher can be seen in the fourth grade students' usage of Spanish throughout the school year. The three students spoke English 71% of the time in all areas of the school including while at recess, in class, and in the

lunchroom. Specifically in class they spoke English 92% of the time, Spanish 3% of the time and both 5% of the time (Pease-Alvarez & Winsler, 1994, pp. 519-520). Granted, this was not a Spanish classroom, but the students were encouraged to use Spanish. They also were entering their first year in an English-only classroom and at fourth grade were surprisingly able to make a shift to speaking in English 92% of the time. Also interesting in the study was the difference in data gathered from observation one to observation five which was taken six months later. Throughout the day, the three students spoke Spanish 29% of the time at the beginning of the year and just six months later the same children spoke Spanish only 8% of the time. The study's ability to provide both numerical data and qualitative descriptions of when and where Spanish and English were used gives it high internal validity. This study shows how quickly students can move from speaking two languages toward the dominance of English. This trend toward speaking more English and less Spanish can be found when instruction is happening in Spanish as reported in the following studies.

Carrigo (2000) and Potowski (2004) examined fifth graders' Spanish usage in the Spanish portion of the bilingual setting. Carrigo (2000) found that in Spanish instruction, students used English 75% of the time in mixed peer groups of Spanish and English speakers. However, they used more Spanish when grouped with all Spanish speakers. Additionally the teachers spoke more Spanish with students who spoke Spanish in the home as compared to those who did not. Spanish teachers using English with students gives the impression that learning Spanish is not as important as learning English.

Potowski (2004) looked closely at four students and found a range of Spanish usage in the Spanish classroom. She used audio recordings of four students which might

change students' regular speaking patterns and habits, which is called an experiment effect. The credibility of this research is high because Potowski also triangulated her data with interviews from the parents of the students and the teacher, she used the audio recordings, and she took detailed observations of the classroom. In the recordings, Potowski found that when the four students talked to the teacher, their language usage was as follows: Student A: 91% Spanish- 9% English, Student B: 83% Spanish- 17% English, Student C: 88% Spanish- 12% English, and Student D: 71% Spanish- 29% English (p. 85). These numbers show a relatively high amount of Spanish usage by these four fifth graders when talking to the teacher. This part of the study is qualitative and can be replicated making it highly transferable. Also, by following the same model of coding the data as Potowski, a researcher can attempt to replicate the results. When compared to talking with peers, the drop in Spanish usage is profound, Student A: 42% Spanish-58% English, Student B: 18% Spanish-82% English, Student C: 50% Spanish-50% English, and Student D: 23% Spanish-77% English (p. 85). The qualitative data from this study shows that students use more Spanish when talking with the teacher than they do when talking with other students. For this reason, the teacher needs to model Spanish usage and value Spanish as a vehicle toward learning more of the language and content.

Maybe most surprising, Kindergarteners in the Spanish half of a bilingual setting were much more inclined to speak in the language that their teacher or the teacher's-aide used predominately. Lagarreta (1977) found that "Spanish-speaking children [5-6 year olds] spoke English to the [English-speaking] teacher's aide an average of 71% of the time" (p. 12). These statistics are alarming because they involve Spanish-speaking children in a Spanish instruction classroom. The same study pointed out that teachers

and aides used English during designated Spanish time 71% of the time to greet, direct, and correct students. This suggests that the teachers' use of English promotes English usage by students. Shultz (1975), as cited in Lagarreta (1977), asserted that the bilingual staff's English usage implicitly sends the message that English is the "advantageous and natural language of the classroom" (Lagarreta, p. 14).

All of the limited research about bilingual schools shows that English and Spanish are not used equally. From Kindergarten to fifth grade, Spanish-speaking students will use English in their classroom more when they think the person receiving the message will most likely understand in English. Students in a fourth-grade, English-only classroom shifted their own usage of Spanish from 29% to only 8% (Pease-Alvarez & Winsler, 1994). Students in Kindergarten spoke English to English-dominant teachers and aides 71% of the time (Lagarreta, 1977). And finally, students in fifth grade spoke English with each other about 70% of the time, when the group had members who spoke less Spanish than English. In conclusion, even in a bilingual setting, in bilingual classrooms, with people who understand Spanish, students speak English a significant amount more with each other and with the teacher. It is a teacher's job, in a bilingual school, to promote an environment that pushes students toward both more Spanish usage in Spanish classrooms and Spanish usage that will increase vocabulary and content knowledge.

School and Community Support for Bilingual Education

For students to thrive in a bilingual or dual-language setting, a well-run school and parental involvement helps increase success. Alanís and Rodríguez (2008) proposed a list of features of a successful dual-language immersion program, which includes the

presence of a strong bilingual staff who are dedicated and under the leadership of a principal educated in dual-language and second-language acquisition. Alanís and Rodríguez (2008) reported that at one dual-language K-5 school in Texas, parents were given opportunities to be a part of the school and stay connected. Parents were asked to volunteer and be a part of meetings and program planning. Parental involvement was also cited in a study by Alfaro, Umaña, and Bámaca (2006) as one key factor in the academic motivation of 310 Latino adolescent students in a survey provided by ninth and tenth graders of five Midwestern high schools. Specifically for girls, the mother and father's academic support had a positive correlation on academic motivation. The same study also showed that teachers' academic support was positively correlated to academic motivation. Further, Howard and Christian (2002) listed home-school collaboration, a four-six year bilingual instruction minimum, and qualified school personnel, which includes para-educators and teachers, as important features to a two-way immersion program. At City Elementary, the bilingual program is a six-year program and parents have access to school activities including volunteerism. This connection to the community can always be strengthened to promote academic motivation and achievement.

Family Funds of Knowledge and Capital

For bilingual programs to be successful, the value of families that include the funds of knowledge and cultural wealth of the Hispanic community needs to be seen in a positive light. Moll, Amanti, Neff, and Gonzalez (1992) argued that "funds of knowledge" come from the home and include the cultural and cognitive resources that can have "*potential* utility for classroom instruction" (p. 134). In their qualitative study,

the researchers showed how they successfully developed a relationship with one family and were able to draw on this relationship to bring a part of the family's heritage into the classroom in a meaningful academic way. Through the lens of the community's funds of knowledge, teachers and families can work together to provide academic content in the non-dominant language. This enables students to value their school, their families, and their teachers because the funds of knowledge are brought from the community into the classroom. Similarly, Yosso (2005) analyzed the potential of the community as being positive for education. She used a critical race lens to promote cultural wealth and assets that an individual or community possess. The assets that she focused on in her work were *aspirational capital*, *familial capital*, *social capital*, *navigational capital*, *resistant capital*, and *linguistic capital*. Yosso's breakdown of these six forms of capital highlighted the often-overlooked ways a marginalized family or community can bring true wealth into the classroom. In a bilingual setting the home language, or linguistic capital, is a form of capital that a school and classroom teacher can value. Parents can come in and talk to students about themselves, their dreams and all the obstacles they had to overcome. In this way the funds of knowledge and capital of the community become assets of the school. The connection between community and school are strengthened and the school can better serve its population in a positive way.

Support for Bilingual Education

As populations shift toward a higher percentage of Latino students, public opinion of bilingual education is shifting too. Mason (2003) cited that there were 38.8 million Hispanics in the U.S. in 2003, making it the largest minority group. She compared this with the statistics from a 2003 Gallop poll that break down those who

avored and who opposed bilingual education for non-English speaking students. The poll classified citizens into three categories, Non-Hispanic whites, Blacks, and Hispanics. For Non-Hispanic whites, 53% favored while 45% opposed bilingual education, for Blacks 73% favored bilingual education while 23% opposed it, and for Hispanics 72% favored bilingual education while 27% opposed it. According to the 2003 Gallop poll, in total, 58% favored bilingual education for non-English-speaking students while 40% opposed it (Mason, 2003, p. 43). Because the United States Census Bureau reports that there were 53 million Hispanics in the U.S. as of July 1, 2012, new polls need to account for this fluctuation in population (Hispanic Population: Census Information, 2013). As Hispanic populations increase, bilingual support figures need to be readjusted. This might affect opinions regarding the effectiveness of bilingual education.

Bilingual Education: Does It Work?

“The American public is under the impression that bilingual education doesn’t work. The reality is that it is effective at improving English in terms of academic achievement” (Krashen & McField, 2005). One concern is that native English speaking students in bilingual programs will do poorly on English tests as compared to other native English-speaking students in traditional monolingual schools. Cummins (1999) asserted that “the data and associated theory show clearly that linguistic minority and linguistic majority students in well-implemented bilingual programs (of various types) will suffer no adverse consequences as a result of spending instructional time through both languages” (p. 28).

Alanis and Rodriguez (2008) examined one bilingual school in which English test scores greatly surpassed other schools in the state and district. For the fifth-grade class

taking the Texas Assessment of Knowledge and Skills, (TAKS), students consistently outperformed their district and state classmates in English-only schools. These fifth-grade TAKS scores for bilingual students showed higher reading, mathematics, and science scores in English. The school scored from the 80s up to a perfect 100 in all three areas across multiple years. Studies like these are not isolated incidents. Krashen and McField's (2005) meta-analysis of meta-analyses provides evidence that bilingual education improves English test scores. One collection of results of five meta-analysis studies ranging from 1985 to 2005 showed "a mean effect size of .26 and a range of .18 to .33" (p. 8). The studies show that bilingual education is producing better results than a monolingual education with a correlation average of .26. Krashen and McField (2005) emphasize that bilingual education aids students in their ability to succeed academically in English. Another meta-analysis study reached similar conclusions. Rolstad, Mahoney, and Glass (2005), in their meta-analysis of English Language Learners (ELLs) bilingual education academic achievements, concluded, "that bilingual education is superior to English-only approaches in increasing measures of students' academic achievement in English and in the native language" (p. 590). In Rolstad, Mahoney, and Glass' (2005) same analysis they mentioned that Slavin & Cheung (2003) "conclude that bilingual education approaches are superior to all-English approaches for ELL students" (p. 590). The meta-analyses show that ELLs in bilingual programs make considerable gains in their English-language abilities. But what gains are Spanish-speaking ELLs making in Spanish?

How Should Spanish Be Taught?

In the same way that ESL differs from English language arts, Foreign Language in the Elementary Schools (FLES) should be more like a Spanish Language Arts classroom. Potowski, Berne, Clark, and Hammerand (2008) drew on “native-language arts standards” from New York State to rethink the model for schools in Chicago. They designed a curriculum that “blend[ed] English Language-Arts standards, Foreign-Language standards, and Content Area standards” (p. 27). I believe that this kind of work that should be done in bilingual classrooms around the country. The teaching of academic subjects in the second language (Spanish) should not be done in a way that makes learning only challenging for those who are non-native Spanish speakers. Students who speak Spanish in the home should be learning new vocabulary and practicing challenging grammatical forms to achieve higher language proficiency. Potowski (2007) asserted that the Spanish form and function should be provided with discourse and feedback. It should “still be contextualized and related to academic content” (p. 208).

What sometimes happens is that FLES classrooms fill up with Spanish-speaking children who may also be dominate in English, but they are not pushed to learn more Spanish. Thus these Spanish speaking students, “typically reap few benefits from a traditional FLES curriculum designed for children who know no Spanish at all” (Potowski, Berne, Clark, & Hammerand, 2008, p. 26). I argue that a dual language program like that of City Elementary School with 70% Latino students who have Spanish exposure in the home has a similar tendency. The other 30% of the population that speaks English only in the home has not obtained enough Spanish to really cover content

in Spanish. Therefore teachers feel inclined to hold the students accountable for their content and not their usage of the Spanish language (Potowski, 2007). As a result Spanish learning is sacrificed to ensure content coverage and Spanish speakers do not learn new Spanish vocabulary.

Building Vocabulary for ELLs and Academic Language

Building vocabulary in any language takes effort and time. A lot of research about English Language Learners focuses on how to assist the English language acquisition needs of students for whom English is a second language. The findings of this research can be of assistance when considering how to increase Spanish vocabulary growth for those who speak Spanish in the home and for those who only receive Spanish in the dual-language immersion setting. Proctor and Mo (2009) studied bilingual (Spanish and English) fourth graders compared to English-only students to test cognates in relation to English comprehension. The study showed that cognates are more proportionally identified correctly by bilingual students than by monolingual students. That means bilingual students rely heavily on cognates or words that are similar in both languages to achieve English comprehension. Another study by Carlo et al. (2004) included cognates in teaching 254 bilingual and monolingual fifth graders English vocabulary. They used a multifaceted vocabulary instruction program that taught students “explicitly how to use context cues, teaching morphological analysis, and teaching about cognates” (p. 70). The researchers found that student comprehension increased as a result of this instruction. By using these activities in Spanish, similar results might be achieved. Hammer, Jia, and Uchikoshi (2011) made the point that research is needed for bilingual students to evaluate their growth in both English and the home language. They

found that students in bilingual settings whose second language is English increase their English vocabulary, but that significant gains in home language are either not made or have not been researched.

A lot of vocabulary development comes out of the need to learn new words that are specific to a content area. This domain-specific vocabulary is referred to as academic language. Zwiers (2008) wrote about the importance of building students' academic language in order to succeed in all school domains, including math, science, history, and literature. "Academic language is the set of words, grammar, and organizational strategies used to describe complex ideas, higher-order thinking processes, and abstract concepts" (Zwiers, 2008, p. 20). Swinney and Velasco (2011) suggested that much of the language needed to succeed in the classroom is outside of the students' home experiences or learned vocabulary. They note that while this can be challenging for regular, monolingual classrooms, it is especially challenging for ELLs and students in bilingual programs. I argue that just as academic English can be outside of the realm for so many students, academic Spanish is no different and must be specifically taught. In another approach toward teaching academic language, Chamot and O'Malley (1987) were concerned about ESL students entering mainstream classes. They designed a lesson plan format that would focus on language demands which would be explicitly taught to students in the preparation and presentation phases of the lesson. They recognized that students might be proficient at English, but not have the academic language skills to be ready for content in domain specific areas like mathematics and science. In the same way, I feel that students who speak Spanish need direct instruction in content specific vocabulary to succeed in subjects like science. That is why a science based, specific

vocabulary building technique needs to be explored to improve Spanish vocabulary and academic Spanish.

Vocabulary Index Cards and Building Science Vocabulary

One strategy to increase vocabulary comes from the implementation of vocabulary index cards and other vocabulary-rich activities embedded in science instruction. Vocabulary index cards can be used in any course in any grade. In a bilingual setting for students with varying Spanish abilities, systematically recording and referencing vocabulary aids in content instruction. My action research focuses on specifically increasing students' science vocabulary with the idea that Spanish science vocabulary needs to improve in a bilingual setting.

Honig (2012) made clear that the language of science is very different from story language; science is an academic language. She cited Blachowicz and Obrochta (2005) in saying that vocabulary instruction should include "Vocabulary Visits" (p. 33). In her science lesson plans, Vocabulary Visits occurred every day and include posters with images, the use of sticky notes to place on the posters, a complimenting idea chart that includes this vocabulary, and journal entries that are shared with partners and require this domain-specific vocabulary. Pries and Hughes (2012) emphasized introducing science vocabulary in an inquiry-based approach. The classroom was divided into stations based on scientific concepts like types and forms of energy. Students were sent off to each station with a word bank and were to use the vocabulary while interacting with different forms of energy like a burning candle, a microwave, candy, and a drum. Students were encouraged to explore the stations and incorporate the vocabulary before having explicit instruction. Pries and Hughes (2012) suggested other vocabulary building activities like

the inclusion of vocabulary notebooks, index cards, and inquiry building stations can be included in science instruction.

Schmitt and Schmitt (1995) drew on many principles of memory research to incorporate in building vocabulary. They suggested including the target word, a definition, a picture of the word, a running tally of how many times the word is seen or heard in a given period of time, different parts of speech in which the target word can be used, and a semantic map of the word in the different ways it can be used. This work is recorded by students on vocabulary index cards that students can manipulate and study. Similarly, Marzano (2009) gave a six-step process for teaching vocabulary. His process includes 1) description or explanation of the term, 2) a student-generated description, 3) a picture, 4) engaging students, by using words from their vocabulary notebooks, 5) student discussion of vocabulary, and 6) games that use the vocabulary. In both Schmitt and Schmitt and Marzano's systems, students are creating meaning with the words. The students are making the vocabulary index cards which include pictures and student descriptions of the word and they are asked to use the words in discussion and activities. One study by Walters and Bozkurt (2009) incorporated the strategies of vocabulary notebooks described by Schmitt (1997). Walters and Bozkurt's study utilized vocabulary notebooks with a group of English as a Foreign Language (EFL) students which resulted in dramatic increases of vocabulary in both receptive tests (matching words with definitions) and production tests (correct use of words in prompt based free-writing). The treatment group in receptive tests correctly identified, on average, 14.55 words out of 36 words as compared to the two control groups' scores of 6.35 and 2.50, respectively. In the free-write task, the treatment group used an average of 10.35 words as compared to

the lower 1.48 and .53 usage of the control groups. The use of vocabulary notebooks correlated to higher vocabulary abilities in Walters and Bozkurt's study. The research about the effectiveness of vocabulary notebooks and index cards led me to incorporate them in a science classroom taught in Spanish. Spanish speakers and Spanish language learners deserve exposure to academic vocabulary and a method to study that vocabulary.

Development of the Research Question

In order to more fully validate the statements that bilingual education and dual-language immersion programs can successfully teach students to become proficient in two languages, Spanish language development deserves more attention. The tendency for students to begin using more English with each other, in the classroom, and in society at large is natural and acceptable. But at the same time it is problematic that students receive minimal exposure to academic Spanish in dual-language programs. Students take half of their classes, including core subjects, in Spanish, but all too often are not held to the same high standard that English receives. Teachers must explicitly instruct students to learn new Spanish vocabulary in different content areas. Research about the qualities of effective bilingual and dual-language schools insists that both languages receive equal attention and that should include explicit vocabulary and academic Spanish instruction.

The students at City Elementary School, like students at other schools in some previously discussed studies, share similarities in the trend toward speaking primarily English (Carrigo, 2000; Potowski, 2004; Pease-Alvarez & Winsler, 1994). By about fourth and fifth grade, Spanish-speaking students from bilingual settings shift toward using more English and less Spanish. Students who speak Spanish in the home are deemed proficient in Spanish. But the label proficient does not address the ability to use

vocabulary in academic subjects. In this way, their Spanish lags behind their abilities in English. For these reasons, I will put a focus on building and using Spanish vocabulary. Specifically, I want students to use the Spanish dictionary to look up words and assimilate them into their vocabulary. Students will utilize vocabulary index cards as a place to write science vocabulary, definitions, personal examples, sentences, pictures, and translations of the words. The science vocabulary index cards will be used to promote domain-specific academic Spanish. In this action research project I will explore the following question: How do student-produced vocabulary index cards in a fifth-grade Spanish science classroom promote academic Spanish usage? Students will be tested on their abilities to match words with definitions, their completion and usage of the vocabulary index cards, and the specific study techniques they utilize with the index cards.

CHAPTER 2—METHODS, CLASSROOM CONTEXT, PRACTICE DESCRIBED, DATA COLLECTION, AND LIMITATIONS

Student Demographics, Language Usage, and Science Classroom

City Elementary's Dual Language Program follows the 50/50 split model where students receive instruction in English and Spanish. The school has a population of 77% of students who are Hispanic, 20% who are white, and 1% other. Overall, 90% of the students receive free or reduced lunch. Students enter the school in Kindergarten speaking one, two, or even three languages. The majority of the Hispanic students speak Spanish in the home and some speak an indigenous language of Guatemala. The rest of the students enter the school speaking only English. In every grade from Kindergarten to fifth grade, students receive instruction in English and Spanish. English language arts, math, and part of social studies are taught in English. Science, Spanish language arts, and half of social studies are taught in Spanish.

The fifth-grade classroom featured in this study is a self-contained classroom, meaning all 26 students receive math, English, science, Spanish, and social studies from the same teacher in the same classroom. As their student teacher these are my students and consequently were the subject of my action research. By fifth grade, most students are conversationally proficient in both languages. However, English proficiency does not translate to passing the Washington English Proficiency Assessment. In the classroom of this study, 13 of the 26 fifth-grade students are labeled as having limited English proficiency. The different English and Spanish linguistic abilities of the fifth-grade students created an environment where content instruction always included language development. For this reason, a science curriculum that highlighted academic vocabulary served to improve Spanish language and content knowledge.

This particular study focuses on science which was taught in Spanish. Students received about one hour of science instruction per day, which included group work, individual work, group experiments, teacher led demonstrations, and an end of the year individual science fair project. Specifically, the study shows how vocabulary index cards affect the building of students' academic Spanish in the science curriculum. The science curriculum at City Elementary does not include the use of a text book, nor is there a district or school-wide curriculum in place. Science is taught by the classroom teacher based on lesson plans designed around standards. The vocabulary in this study was based on lessons designed around the Next Generation Science Standards (NGSS).

Vocabulary Index Cards in Action

A vocabulary list was provided to students at the beginning of the study (see Appendix A). In the four-week period, students worked with 20 vocabulary words that came from material that was being covered within the integrated science units. I modeled on chart paper how to make vocabulary index cards which followed the approach outlined in Pries and Hughes' (2012). Students used large five by eight inch index cards to write the vocabulary and other information as described in the vocabulary index cards section. Some of the ideas about index cards to promote vocabulary came from Schmitt and Schmitt (1995). In their article they have diagrams of how the index cards can be set up. An example from Schmitt and Schmitt is shown to the right. Also, these ideas utilize

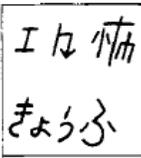
L1 translation of <i>horror</i>	keyword illustration (<i>horu</i> = dig)
	
intense fear, dread	The family watched in horror as their house burned.
L2 information	Example sentence

Figure 1. Vocabulary index card from Schmitt and Schmitt (1995).

the first three of *Six Steps to Better Vocabulary Instruction* from Marzano (2009). The index cards, as a place to keep important science vocabulary (academic Spanish) and a way to study that vocabulary, were the focus of this action research. The idea was for the students to complete the vocabulary index cards on their own as new words were being discovered and used during science instruction. Then I wanted students to have time to study those index cards and have a focused lesson on different approaches to studying. Finally, the project concluded with a posttest which students would be allowed to study for with their vocabulary index cards.

Data Collection

The enactment of science vocabulary index cards in Spanish was examined in a number of ways to show how it promoted academic Spanish usage. Students were given a pre- and posttest matching vocabulary with definitions to show which words they knew. All students' individual vocabulary index cards were analyzed for completeness, detail, and organization. Also videos were used as a data source where students were filmed studying the index cards to reveal the study techniques used by individual students and trends in the classroom. In addition, video recording of a science activity and presentations showed how students used the academic vocabulary with each other. These different data sources included quantitative and qualitative information making this a mixed-methods study (Mertens, 2009). The pre- and posttests, the academic Spanish index cards of science vocabulary, and the videos of students studying and using the vocabulary represent triangulation of the data sources. This triangulation adds to the credibility of the study (Mertens, 2009). All data points were used to analyze how academic Spanish usage was promoted in a fifth-grade science classroom.

Receptive Vocabulary Pre- and Posttest

All of the 20 vocabulary words were tested before and after the three weeks of instruction. The receptive vocabulary test described in Walters and Bozkurt (2009) provides a model for testing vocabulary that establishes a knowledge base and change over time. A list of terms was provided and 20 scientific definitions were given. Students matched the vocabulary words with the definitions. The same test was given before science instruction began and after the four weeks of instruction and the vocabulary had been taught and studied. I did not provide any accommodations for the students for the test and allowed them enough time to finish the test. I gave the test to the students as they were seated in their desks which were evenly spaced out throughout the class. I did not collect the tests until all the students said they were finished. It took 25 minutes to administer the test. Students were not given the results of the tests to eliminate the ability to explicitly study the words and definitions directly from the test sheet. Quantitative growth from before and after was not as important as a students' perception of increased vocabulary usage through immersion with the academic Spanish vocabulary and specifically studying of the vocabulary. Also, students knew that the posttest was coming and many were motivated to study the vocabulary index cards that the students created. This data source is purely quantitative and students were graded on how many words they matched correctly out of 20. The scores students received were compared to students home language, whether they completed the vocabulary cards or not, and how they were shown participating with the vocabulary in the videos. The goal of this study was to see how to promote academic Spanish usage by creating vocabulary index cards as a means of studying academic vocabulary. The posttest helped make

students more likely to study the index cards. They also gave me some numerical data to associate with students as I considered their academic Spanish usage.

Vocabulary Index Cards

The vocabulary index cards were presented to the students as a way to hold on to important information about the twenty academic Spanish vocabulary terms that would be central in working with the science lessons. I chose the words by looking at the standards we were working on and which extra activities we would do. Students were shown how to create

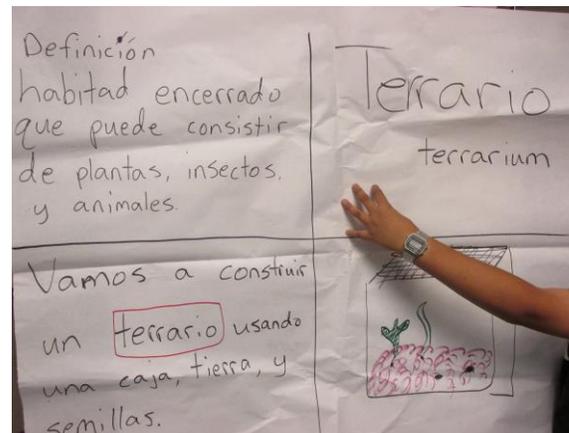


Figure 2. Vocabulary Index card on chart paper.

the vocabulary index cards during the first week of the study. A large, poster-size example was used with the word terrarium (terrario). This word was new for most students and they were able to use it numerous times when they built and observed their terrariums. Students were encouraged to be creative and find ways to make the index cards work for them, which included personal examples and decorating the cards with color. All students needed to complete the 20 index cards throughout the four weeks and ensure that they included the vocabulary word in Spanish and its English translation, a definition of the word, a student-generated sample sentence using the word, and a sketch of the word. Students were given a copy of all 20 terms and their definitions. Students were given time to work on these notecards in class in chunks as more of the terms were being revealed in the classroom. The expectation was to work on the vocabulary index cards as one of the activities during science time. Two pairs of students were recorded

studying and this was shown to the class as one example of how to study with the vocabulary index cards. In total the cards were studied on three occasions with a discussion of different ways to study the vocabulary index cards. The vocabulary index cards were evaluated using a rubric (see Appendix B) on completeness, attractiveness and organization, the picture, and sentence creation. A maximum score of 12 could be achieved using this rubric. Also notes from my observations of students creating the index cards help to paint the picture of how students interacted with this assignment.

Video Recording

At times throughout the four weeks of science instruction a video camera was used to capture students using scientific vocabulary. This occurred during time devoted to discussing the vocabulary and how to make the cards, during a group project where students created a poster of the water cycle, and during small group study time. These video recordings, as a data source, provided a more colorful picture of how students went about studying with index cards. As Auerbach and Silverstein (2003) suggest, I made the videos that I selected to use manageable. I have over twenty video clips of students and had to choose the relevance of the material in each video. I followed four questions provided by Auerbach and Silverstein, “Does it relate to your research concern? Does it help you understand your participants better? Does it clarify your thinking? Does it simply seem important, even if you can’t say why?” (Auerbach & Silverstein, 2003, p. 48). The video captured students using and helping each other with the science vocabulary in Spanish. I was able to describe students who were both engaged and disengaged with Spanish science vocabulary. I also captured excerpts from the videos that would give answers to the question of how students were using the vocabulary index

cards as a tool for studying academic Spanish in science. The videos helped to describe individual students' engagement with the science vocabulary in relation to their pre- and posttest improvement and their completion of the vocabulary index cards. The video recordings complement the other forms of data collection because it shows how the vocabulary is actually used by students in a science classroom.

Quality Indicators and Limitations of the Study

All research has limitations and each method has particular limitations. The receptive vocabulary test provided data about how many words students could identify correctly, but it did not specify whether a student answered correctly or guessed correctly. It also did not take into account the ability to use and apply the word in a science context outside of a definition. This kind of test is highly objective because there is one fixed answer for each question. But this kind of test will not prove that the test results are caused by the vocabulary index card implementation and studying. I am not using the test for that purpose, but as a way to promote students' usage and studying of the vocabulary index cards. However, by providing the list of vocabulary words and the definitions used, this study can be more closely transferable to another similar setting in a dual-language program.

Making the decisions about which video segments to use and even when to actually record affected what data was analyzed. Also, the ability to summarize the data and make generalizations was highly influenced by my own biases. The videos did not show what everyone could say about a word or concept, but only focused on those who were willing to talk in front of the class and a camera. Also, the camera could not capture learning that happened as a result of listening to academic discussions, but better revealed

who was actively listening. What the camera provided was another resource for hearing academic vocabulary develop in students who were learning new words and possibly a new language. Another limitation to using video was the fact that some people act differently in front of a camera. The conversations may have been more formulaic and some students may have been more timid. Further, I did not provide enough opportunity for the participants of the study to offer their personal voice on the process of making the vocabulary index cards and using them to study for the vocabulary test. A member check would have increased this study's credibility by providing key information about the usefulness of the notecards and the students' likelihood to use them in the future (Mertens, 2009).

Overall, my data collection methods were designed to complement each other. By triangulating the data I hoped to capture more information than I could receive with just one method. The information gathered from one source was compared to the information from the other two sources, which helped to improve the study's credibility (Mertens, 2009). I provided thick description of the participation classroom and the demographics of both the school and the classroom. I also described the kinds of activities that were being taught in science in conjunction to the vocabulary index card implementation. This thick description of this classroom and the school at large helps to provide to the reader enough context to determine if this study is transferable to another school and classroom (Mertens, 2009). This study looked at how vocabulary index cards promoted academic Spanish vocabulary usage in a science classroom. I have provided some examples of student work, the vocabulary words that I used in this science unit (see Appendix A), the criteria for evaluating the index cards (see Appendix B), and excerpts

and interpretations from the videos that showed students studying the index cards. This information acts as a chain of evidence that the reader can use to confirm my major findings. It also adds to the rich, thick description that help the reader determine what parts of this study are transferable to a new setting with a new population of learners. In this study I wanted to give students a way to focus their attention on academic Spanish and a tool that they could use to study it. In this way I feel this study is transformative because students are learning how to study academic vocabulary after it has been introduced in authentic contexts.

CHAPTER 3—FINDINGS AND IMPLICATIONS

The use of Spanish vocabulary index cards with a specified list of 20 academic words from the science curriculum was the focus of this investigation. I specifically chose not to focus on English language gains, how students improved during English time, or how much Spanish was used in the English classroom or vice-versa. I have shown that much of the bilingual and dual-language research already focuses on this. I wanted to shed some light on students' usage of new Spanish terms and on how vocabulary index cards could help students focus their studying skills on learning new Spanish terms. Because this researcher feels bilingual education is important for improving both languages through the content areas, I gave students the opportunity to do just that in their science class time. This research focused on how science vocabulary index cards promote academic Spanish usage for students in a fifth-grade classroom in a bilingual setting. Students worked with the scientific terms during their Spanish-science time and the notecards were one way to focus students on improving their vocabulary. The results of this research can be broken down into three findings: the improvement of all students' academic Spanish vocabulary, qualities of students with high test and rubric scores showing academic Spanish usage, and the similarities between the lowest achieving students in terms of vocabulary index card completion and test scores.

Finding One: All Students Vocabulary Usage Improved

All students received a better score on the vocabulary posttest which can be attributed to a number of factors. The vocabulary index cards likely helped students to study and gave them one extra opportunity to work with the vocabulary. The pre- and posttests asked students to match the twenty vocabulary words with their scientific

definitions. Words like *watershed*, *runoff*, *biosphere*, and *living organism* were used on the exam. For a complete list of words from the exam in Spanish and English see Appendix A. After four weeks of instruction, all students had worked with the vocabulary within their science units and had been given time to create and study the vocabulary index cards. The posttest scores were one way of looking at how students were able to use academic Spanish. Below is a table of scores for all 26 students for the pre- and posttests.

Table 1
Pretest and Posttest Scores for Whole Class

Student #	Home Language	Pretest Score out of 20	Posttest Score Out of 20	Point Gain from Pre to Post
1	English	0	1	+1
2	English	1	6	+5
3	English	17	18	+1
4	Spanish	0	5	+5
5	Spanish	1	6	+5
6	Spanish	3	4	+1
7	English	8	17	+9
8	Spanish	6	20	+14
9	Spanish	0	7	+7
10	English	1	2	+1
11	English	0	8	+8
12	Spanish	2	3	+1
13	Spanish	16	17	+1
14	Spanish	5	14	+9
15	Spanish	5	20	+15
16	English	10	18	+8
17	Spanish	8	18	+10
18	Spanish	1	18	+17
19	Spanish	1	2	+1
20	English	0	11	+11
21	Spanish	4	7	+3
22	Spanish	5	13	+8
23	Spanish	10	16	+6
24	Spanish	0	5	+5
25	Spanish	11	20	+9
26	Spanish	11	20	+9

An indicator that academic Spanish usage had increased from pre- to posttest was the increase in test scores across the board. For all 26 students, scores increased with ranges of increase of one point for seven students to an increase of seventeen points for another student. While improving by only one point might not be significant, the fact that no student got the same score or lower from one exam to the next is significant. The improvements in the posttest match with research from Walters and Bozkurt (2009) where ESL students using vocabulary notebooks dramatically improved scores in a vocabulary-matching exercise. This set of data, shown in the table above, shows that all students' academic Spanish usage increased.

Home Language Effect on Spanish Language Usage

The home language is certainly a determining factor in Spanish language usage. In general for students who speak Spanish in the home, science time in Spanish comes easier and I would say it is a huge strength for these students and for a dual-language program. For this study, students who speak English only in the home made fewer gains from the scores on the pre- and posttests. Also students who spoke English at home were less likely to speak during a presentation and on camera.

In the pre- and posttest scores, the results are interesting when compared by subgroups splitting the class between the eight students who speak English in the home and the eighteen who speak Spanish in the home. Both groups had about the same starting point on the pretest scores, but a significant difference in the posttest scores. The English-as-a-home-language group averaged 4.6 correct answers on the pretest and 10.1 correct answers on the posttest. The Spanish-as-a-home-language group averaged a 4.9 on the pretest and 11.9 on the posttest. That gave the English-as-a-home-language group

an average increase of 5.5 points and the Spanish as a home language group an average increase of 7 points. Overall, the students who spoke Spanish in the home made more gains on the posttest than did the students who spoke English in the home. This fact surprised me because intuitively I would have thought that students whose home language is English would have more to gain from the two tests and the subsequent instruction in between. But perhaps the academic Spanish words and definitions were still out of their reach after the instruction. Conversely, for those who do speak Spanish at home, the posttest might have been easier to navigate and score higher on.

The fact that academic Spanish was the focus of this vocabulary learning, allowed for more benefit to be had for the majority of the students who are Spanish speakers in the home. This aligns with the guidelines established by Potowski, Berne, Clark, and Hammerand (2008) who wanted to avoid the trap that Spanish-speaking students “typically reap few benefits” when the curriculum is targeted at the students who are dominant in English (p. 26).

Vocabulary Index Cards: Just one Form of Vocabulary Exposure

The average score on the pretest was 4.9 while the average score of the posttest was 11.4. This increase of 6.6 points attests to the students’ increased exposure to the terms on the exam. It cannot be said that the practice with vocabulary index cards caused this increase in scores, but it certainly was one factor. It is important to explore the panorama of possibilities for the increase of academic Spanish vocabulary, which is, after all, the purpose of this action research investigation.

As one student was studying her index cards, she said, “I already know a lot of these words because we have been using them in science.” Many of the students’

example sentences on the vocabulary index cards included activities that we were doing in Science. For example, one student wrote (translated into English), “We made a poster of the water cycle.” Another sentence from a different student was, “We made a terrarium with Mr. Bennett and it had to be closed.” All students performing better from the pretest to the posttest can directly be attributed to the fact that the terms were used during the science teaching, which included the vocabulary index cards, but also a variety of other science activities.

The words about the earth systems were discussed in class and later students were allowed to take pictures and write about them during a creek walk activity that everyone participated in. Students were looking at the how earth systems interact in our community and where the water from our downtown creek comes from and where it goes. The water cycle was discussed during the creek walk where students followed the creek and mapped it out from a lake to the ocean. Also, students watched videos about terms from the water cycle and made posters and a paper watershed where they worked with terms like *runoff (escorrentía)*. Finally, the students planted seeds in a terrarium to see what grows best under which conditions. This activity used the terms from science experiments as well as vocabulary relating to living and non-living organisms. The point is, all students were hearing these terms in the context of real scientific work.

I cannot say that the vocabulary index cards were the sole cause of the increase in scores from the pretest to the posttest. I can say that the vocabulary index cards were used as another activity where students could document the words, their definitions, a sentence, and a picture. By doing this, students could then study the words and show

what they learned as a result of the whole science instruction time, not just the studying of the index cards.

Finding Two: High Test and Rubric Scores and Academic Spanish Usage: Mostly Females

Another theme that emerged is that the students who volunteered to be the presenters of their groups during a group project seemed to have more control of the vocabulary usage, had higher posttest scores, and worked to completion of the vocabulary index cards. The majority of the students who did seem to have a better handle on using the academic Spanish vocabulary based on the criteria above were female. This evidence comes from the videos of students presenting the water cycle, video of students who finished the vocabulary index cards early, testing data from the early finishers, an analysis of the videos showing students studying, the posttest scores of boys versus girls, and the rubric scores of the vocabulary index cards. Below is an analysis of the data that show that, in this particular study, female students showed greater confidence, a better understanding, and better ability to use academic Spanish in their science classroom.

Water Cycle Poster Presenters

One of the activities that involved the use of academic Spanish terms was the creation and presentation of the water cycle with posters. Six groups were asked to make a poster about the water cycle, label all the terms, and describe the water cycle with these terms. Each group had the freedom to choose who was presenting this poster and all groups had time to practice their presentations before being filmed in front of the class. All the groups decided to have two people presenting the poster and the other members stood behind the posters holding their work. The presentations lasted about two to three minutes and some students used notes to give the presentation. Of the twelve presenters

for the six groups nine were girls and three were boys. Because the class is evenly split between boys and girls, this disproportion of more female presenters is a legitimate finding. Nine of the thirteen girls in the classroom volunteered to present their posters while only three of the thirteen boys volunteered. This disproportion corresponds with the girls increase from pre- to posttest scores and the scores and completion of the vocabulary index cards. If this study were to be replicated it would be important to observe this trend that girls show in multiple ways a greater usage of academic vocabulary. It could be purely by chance that this class showed Spanish usage of academic science terms in this way, but it could also be a trend that deserves more attention.

Early Finishers: Filmed Studying

As a data source of this action research project, I filmed students studying with their vocabulary index cards. As the class was working on different science activities which included the creation of the vocabulary index cards, I asked two pairs of students who had already finished creating all twenty index cards if I could film them studying. Of these four students, three were female and one was male. These students were not given any instructions on how to study the index cards but I wanted to use these clips to show to the whole class as a way to model ways that all students might approach studying the index cards. In the videos of the early-finishing students studying, the first pair took under three minutes to go through all 20 cards. They simply read the term and then read the definition and their sample sentences. The dialogue was nothing more than two students reading their notecards to each other. This is one exchange by these two students (translated into English):

Student #20: Terrarium. Enclosed habitat that can consist of plants, insects, or animals. My sentence is, “Last year in fourth grade we made a terrarium.”

Student #3: Biosphere. It’s where you find all living things including plants, animals, protists and bacteria. Biosphere is living things in our city. We have biosphere.

This kind of studying could easily have been done by one of the two students alone. Nothing was added to or questioned by the other student. In the whole clip of these two students studying not one question was asked from one student to the other. One reason that the students did not venture out from reading the index cards might be because both students home language is English. Spontaneous questioning or trying to recall a definition from memory might not have been easily accessible at this stage in working with this relatively new vocabulary. At the end of the study session I asked these students about their studying with vocabulary cards in the past. These are the responses that were given (Translated into English).

Teacher: Have you both studied with cards before?

Student #3: Yes (Nods her head).

Teacher: What have you learned before by studying with cards?

Student #20: (Spoke in English) We read ’em... and then we read um... we read ’em lots of times and then we can know what they mean.

Student #3: We can have more than one definition to know if we don’t, if we don’t know if it’s one of the definitions.

Both students understood my question that was asked in Spanish, but student #20 responded in English. Her idea of studying with vocabulary cards was to read them lots

of times which is what both girls were doing in the video. Student #3 gave her response in Spanish and seemed to have another strategy to study. Her answer was unclear, but I think she was saying that you can study by guessing the definition and knowing what definition does not match the word. This video was later shown to the whole class to talk about different ways to study with the vocabulary index cards.

The other pair of students included a boy and a girl who both speak Spanish in their homes. Their fluency in reading in Spanish was noticeable in comparison to the first pair of students. Both students also read their notecards to each other, but they were not facing each other and did not look at each other very much. At the end of their studying I asked them some questions. I asked what they think it means to study vocabulary index cards. The boy seemed to be thinking hard about the question, but did not give an answer. The girl jumped in and gave a long answer that basically said that I wanted them to learn the definitions of the words. Then I asked them the following (Translated into English):

Teacher: How were you both studying? What way were you studying?

Student #25: Learning when we were reading.

Student #15: Reading the cards.

Teacher: To me it seems you were studying for the first time by reading the cards.

Teacher: How long did it take you each to make one card? Like one minute, two minutes, five minutes.

Student # 25: Five minutes.

Student #15: (Nods her head in agreement)

From this exchange it is clear to see that both students idea of studying their vocabulary index cards meant to read them to learn them. It is also interesting to note that these students said that making the cards took about five minutes each which could be taken into account when assigning card creation in the future. These four early finishers, of whom three were female, all had one way of studying. Both videos show the same studying technique which demonstrates why students need to be introduced to other forms of studying that can be applied to studying vocabulary index cards.

Early finishers: Vocabulary Usage Success

One interesting piece of information about the four students who finished the vocabulary index cards first is their vocabulary posttest scores and their rubric scores of the actual index cards. Again, three of the four students in this early finishers group were female, which shows a possible link of greater usage of the vocabulary terms. The scores of these students are shown in the following table:

Table 2
Pretest and Posttest and Vocabulary Index Card Scores for Four Early Vocabulary Card Finishers

Student #	Gender/Home Language	Vocabulary Index Rubric Score out of 12	Pretest Score out of 20	Posttest Score Out of 20	Point Gain from Pre to Post
Student #3	Female-English	9	17	18	+1
Student #15	Female-Spanish	11	5	20	+15
Student #20	Female-English	9	0	11	+11
Student #25	Male-Spanish	9	11	20	+9

The four students made their index cards without any real assistance from me. They also did not score among the highest in the class on their creation of the vocabulary index cards based on the rubric. However, I would say that based on the score increases from

pretest to posttest and the high posttest scores, whatever they were doing worked. Two of the students got perfect scores on the posttest while another student increased by eleven points. This information may be somewhat misleading because students who generally finish early might also be expected to perform better on an exam that comes later. Another explanation could be that these students finished early and thus had more time to study for the exam. The fact remains that these four students did something that allowed them to make gains from the pretest score to the posttest score, where three of those students made significant gains.

Vocabulary Cards Study Techniques

An independent conversation with student #3 revealed more information. She told me that she has made flashcards to study both in other classes and on her own at home. She said that when her family goes on trips they make flashcards so that they can learn new things. These kinds of habits are what I hoped to instill in the other students in the classroom. I wanted them to see index cards as a way to

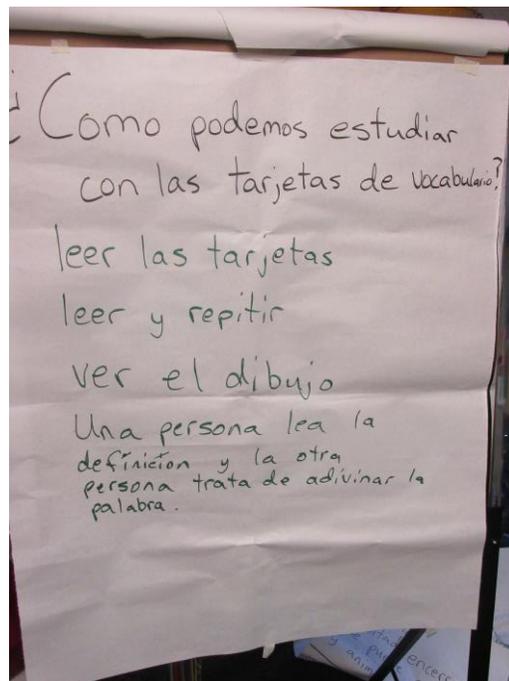


Figure 3. Poster listing ways to study.

store information that can later be studied and committed to memory. By showing the video of the first group studying to the whole class, I was able to provide an example of

how to study. This opened a space for a discussion around other ways that our vocabulary cards could be studied. The result of this conversation was the poster shown. The poster says, “How can we study with the vocabulary cards?” Students identified the following ways: read the cards, read and repeat, look at the picture, and one person reads the definition and the other person tries to guess the word. Students were encouraged to try different studying techniques when engaging with the vocabulary index cards.

Video Analysis of Students Studying

The whole class studied their vocabulary index cards on two separate occasions. Students were encouraged to study more than that, but these times were designated for everyone to study. In total I captured nine videos of students studying during these two sessions. Only one of the videos was of a boy studying by himself and all the rest were of pairs. In the backgrounds of the videos, pairs of students can be seen studying which made the atmosphere quite academic and focused. From these nine videos I found that most followed the read-the-cards method, but a couple of pairs did it differently and both of those pairs had some significant results.

Most groups chose to merely read their index cards to each other which was exactly what the early finishers did. I had shown two videos of the early finishers studying and while we discussed other studying strategies that the students could do, none of these strategies were explicitly modeled with students acting them out. This is certainly an area that I can improve when I teach how to explicitly study in the future. Of the nine groups seven were studying with the reading the cards method. Like the early finishers, they just read each other the word and the definition and in some cases the

example sentence. These groups were able to self-identify the study method that they were using, and one was able to try out another method with my guidance.

Two groups were different in that they were not simply reading their cards to each other. One of the groups had one person reading the definitions and the other person guessing the words. When the person could not get it, the first person showed the picture as a clue. This is the kind of studying that I was trying to encourage all students to use. I certainly could have shown this video to the whole group between the first study session and the second. Then I could have asked students to all try this method rather than letting students decide. The other group was studying in a way not identified by our whole class. One person was reading only the word and the other person had to recall the definition. It was obvious when the student knew the word and both students seemed to really be into this strategy. For these four students their ability to study in a way that was causing them to think and test themselves produced impressive results as shown in the following table:

Table 3
Pretest and Posttest Scores for Students Who Studied Differently

Student #	Gender/Home Language	Pretest Score out of 20	Posttest Score Out of 20	Point Gain from Pre to Post
Student #8	Female-Spanish	6	20	+14
Student #18	Female-Spanish	1	18	+17
Student #25	Male-Spanish	11	20	+9
Student #26	Male-Spanish	11	20	+9

These two pairs of students received excellent scores in the posttests and all made significant gains as well. Interestingly all four students speak Spanish in the home. I wonder if for these students, speaking Spanish allowed them to leave the security of reading the notecards to try and quiz each other instead. This might be an area for future research. But certainly this correlation between studying in a style that quizzes the other

student and high posttest scores leads me to the following recommendation. Students need to have time with studying their notecards and then another discussion of techniques should be explored. I wish I would have shown the videos of these groups studying and then directed the whole class to try out a strategy similar to theirs. If I would have done this, would more students have mastered these academic Spanish terms?

Pretest to Posttest: Girls vs Boys

On average, girls outscored the boys on both the pretest and the posttest. In addition the girls' average improvement from pretest to posttest was 7.9. This compares to an increase of only 5.2 points by the boys. Girls started with scores at 6.2 and boys at only 3.5. Further, girls scored on average 14.1 points on the posttest, with boys coming in at 8.7 points. In terms of an average percentage score, girls would have passed with a 70.5% whereas boys would average a meager 43.5%. This significant difference in posttest scores and gains is highlighted in the videos of students studying and the volunteer presenters for a poster project on the water cycle.

Table 4
Pretest and Posttest Scores Separated by Gender

Gender	Pretest Score out of 20	Posttest Score Out of 20	Point Gain Pre to Post	Gender	Pretest Score out of 20	Posttest Score Out of 20	Point Gain Pre to Post
Male	0	1	+1	Female	17	18	+1
Male	1	6	+5	Female	6	20	+14
Male	0	5	+5	Female	0	8	+8
Male	1	6	+5	Female	2	3	+1
Male	3	4	+1	Female	16	17	+1
Male	8	17	+9	Female	5	14	+9
Male	0	7	+7	Female	5	20	+15
Male	1	2	+1	Female	10	18	+8
Male	8	18	+10	Female	1	18	+17
Male	1	2	+1	Female	0	11	+11
Male	0	5	+5	Female	4	7	+3
Male	11	20	+9	Female	5	13	+8
Male	11	20	+9	Female	10	16	+6
Average	3.5	8.7	5.2	Average	6.2	14.1	7.8

Vocabulary Index Cards: Notes and Scores

The launch of the vocabulary index cards was done as a collective group and all students finished the first two cards together. Some interesting occurrences happened during times when students were working on the index cards and some noteworthy examples are included here. While students were creating the cards, one student commented that she really liked doing these cards. This same student was very expressive when she studied with her partner a couple of weeks later. On the day of the launch, two girls brought the cards with them when the whole class was brought to the restrooms and they worked on them in the halls while they waited. This kind of excitement was not expressed by any boys.

An interesting phenomenon I noted in my research journal was that students were having a difficult time coming up with the English translation for words that they could have guessed based on the cognate relationship between the two languages. In one instance, the word in Spanish was *precipitación* which translates to precipitation. I was quite shocked that two students whose home language is Spanish and are conversationally bilingual went to the dictionary to look up the word to include it in English on their index cards. Several situations could be happening in this instance. Two that I considered are that the boys might have never heard of this word in English, but knew it in Spanish, considering that all previous years of science have been taught in Spanish. Another potential explanation is that this word could have been new in both languages, and as a result would have been impossible to know that it was a cognate.

Overall, female students had a higher completion rate of the vocabulary index cards, scored higher on them, and this correlates to a higher final score and point increase

from pre- to posttest scores. I would also say that the girls were in general more excited both while making the index cards and while studying them. A rubric (see Appendix B) was used to evaluate the vocabulary index cards based on completeness, attractiveness and organization, the picture, and sentence creation. The rubric had a maximum score of 12 which was achieved by only two students. The scores for the rubric are displayed below in a table split by male and female scores.

Table 5
Rubric Scores for Vocabulary Index Cards

Gender	Vocabulary Index Cards Rubric Score Out of 12	Gender	Vocabulary Index Cards Rubric Score Out of 12
Male	-	Female	9
Male	10	Female	11
Male	4	Female	9
Male	-	Female	-
Male	8	Female	12
Male	4	Female	11
Male	9	Female	11
Male	-	Female	11
Male	9	Female	10
Male	-	Female	9
Male	9	Female	9
Male	9	Female	12
Male	9	Female	11
Average from Males who finished	7.9 out of 12	Average from Females who finished	10.4 out of 12

This chart is split by gender and shows another way the girls in this fifth-grade classroom outperformed the boys in academic vocabulary usage. Two glaring characteristics stand out in this chart. The first alarming piece of data is that four boys did not turn in their vocabulary index cards. Four of thirteen boys simply did not get evaluated because they either lost them, left them at home (permanently), or did not do them. Because we all did the first two index cards together, this really was alarming.

The other figure that speaks to other data sources is the average score of the female students who did turn in the cards compared to the males who did the same. Female students averaged a 10.4 out of 12 as compared to the male average score of 7.9. In fact, the average female score on the notecards was higher than the highest males score. I interpret this to show that the girls took the creation and completion of the vocabulary index cards more seriously. Greater care was utilized in making the cards, and I would argue that greater investment was made in using those cards as a tool for studying the academic science vocabulary.

An example of student work from two different students shows how different the products can be. Figure 4 shows the dedication taken by this female student in

organizing her notecard, providing a picture that enhances the word, and coming up with an example that shows understanding of the term. Her example

sentence says, “When I make something hot the

water evaporates because I heat it.” It takes time to think of a sentence that shows meaning and a picture that clues the brain into the definition of the word. Two criteria on the rubric are: Sentences are thoughtful and show creativity and understanding of the word and the pictures all represent the word and some may include color. Research by

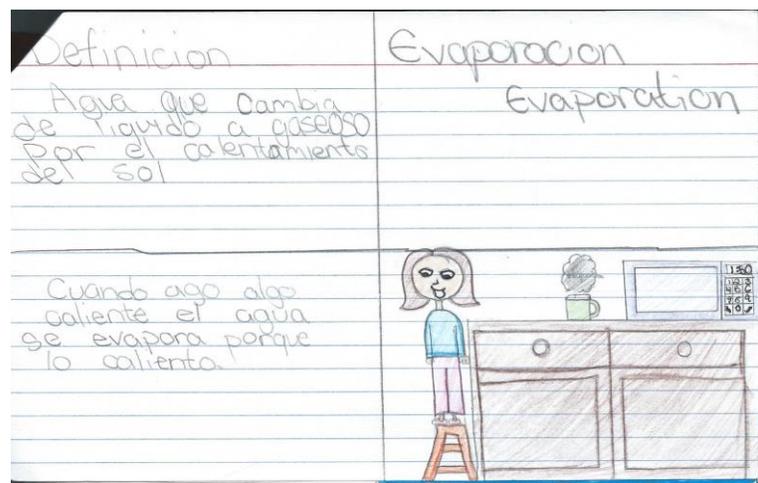


Figure 4. Sample work of high-scoring student, female.

Marzano (2009) has shown these to be effective vocabulary building strategies. I did not expect students to all achieve work like this student did, and not all students needed to have such fancy notecards to achieve success in learning the new vocabulary. This is evident from the vocabulary scores from the early finishers in table 2. The next example shows a different level of dedication in the creation of the index cards.

This first example is placed in opposition to a male who drew a picture that did not fully illustrate the word and whose sentence does not give meaning to the word. His sentence reads, “The watershed are very important.” This

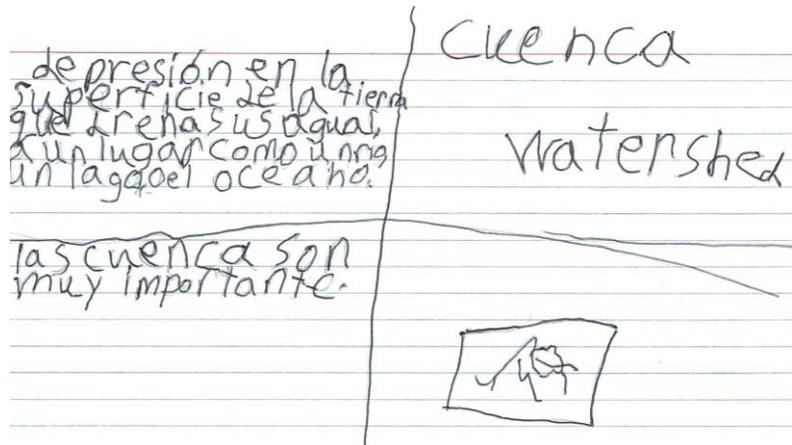


Figure 5. Sample work of low-scoring student, male.

notecard while complete did not meet my expectations and hopes for this student. However I was surprised when I compared the vocabulary posttest scores of these students. Both students received a posttest score of 17 out of 20. This goes to show that some students can excel in one area of a unit of study, but others can go about learning the same information in different ways. While the path that this boy took in achieving a respectable score was not the same as the girl’s score, he did show tremendous growth (eight points to seventeen) in his test scores and I can assume his academic vocabulary usage increased as a result of his work throughout the science instruction.

I was pleased that many students dedicated time to the creation and later studying of the vocabulary index cards. I wish more students would have turned in their work and that all students would have tried the different techniques that were discussed when using the vocabulary cards to study. There is strong evidence that for the students who did create the vocabulary cards and scored well on them, many improved greatly in their Spanish vocabulary usage. While on average the female students spoke more on camera, did better with the creation of the vocabulary index cards, and outperformed the boys on the post-vocabulary test, all students did improve and increase their exposure to the academic Spanish vocabulary terms presented in science. Still, it is imperative to look at students who did not make as great of gains and what might be underlying causes or shortcomings in the instruction.

Finding 3: Similarities between Five Students with the Least Gains

This study about how to promote academic Spanish in a science classroom cannot simply focus on the successes or the overall trends. The fact of the matter is that a handful of students did not make significant progress and were quite frankly being underserved. Some similarities between these students as well as some further descriptions of the individuals help to show who these students were. Further, I consider some ways that I could have reached out to these students and increased their involvement with the science concepts and terms we were learning.

The students who made the least gains from the pre- and posttests have similarities including the majority have a home language that is not Spanish, some have an extraneous factor like an IEP, one has a behavior concern, one is a recent arrival, the majority are male, and the majority did not do or turn in their science vocabulary index

cards which were later used to study for the posttest. Five students fell into this category and were identified based on their inability to increase by more than one point on their posttest vocabulary exam (note: two other students only increased by one point, but their posttest scores were 17 and 18).

Student-by-Student Description

The first student is a boy who does not speak Spanish in his home and speaks very little of it in the classroom. He has an IEP and struggles with reading and writing; it is no surprise that he did not turn in his vocabulary index cards. Clearly making him do this assignment just like all the others was not providing the appropriate accommodations that he needed. In one of the videos of another pair studying, this boy looks directly at the camera and then turns around and goes back to talking with his partner about something in English. Neither of the two boys had index cards in their hands to study. His study partner is another boy who only improved by one point, also does not speak Spanish in the home and seldom in the classroom, and has an IEP. This student also did not turn in his vocabulary index cards. For both students I should have paired them up with a student who was stronger in Spanish. I should have noticed that they did not have index cards to study and found a solution. Instead these students sat with each other and comfortably spoke in English, like so many bilingual studies point out (Lagarreta, 1977; Pease-Alvarez & Winsler, 1994). It seems in my hope to improve academic Spanish fell short for these two students who primarily speak English.

A third boy who only improved by one point was a student that sometimes has trouble staying on task and shows behavioral difficulties. This student speaks Spanish in the home, but has transitioned to using mostly English with his friends and even with his

father. This student was not on an IEP, but was identified by staff in the school as a student to keep an eye on both in class and on the playground. This student did not turn in his vocabulary index cards, but he did study with a partner. While his partner was reading for the camera, this student was whispering the word repeatedly causing his partner to stop and look at him before continuing. I could have better served this student by asking an adult to study with him. I knew, that with this student, partner work could be a distraction and I could have utilized an adult to focus his attention on the work at hand.

The partner of the third student was another boy who fell into the group of students who improved by only one point. This fourth boy does not have an IEP, does not have behavioral issues, does speak Spanish in the home, and did turn in his vocabulary index cards. He is however the only boy that chose (after studying with his partner the first time) to study alone. I have no real explanation as to why this student performed so poorly except for that he did not get the same quality study time as some of his peers.

The final student in this group was a girl who was a recent arrival to the country. Her previous education had some gaps and her reading and writing abilities in Spanish do not match her abilities in speaking. This student spoke Spanish in the home, but did not speak frequently with her peers. She certainly was still transitioning into the classroom and the group of students. Unfortunately, I did not receive vocabulary cards from this student, though I did see her working on them multiple times. I also did not capture her studying on camera. This shows how I did not reach out to this student and make sure she was included. For students like this, who speak Spanish and come from a Spanish

speaking country, bilingual education is supposed to be the best option. The Spanish time of the day is supposed to be where a student like this can feel competent and even shine. I could have given this student more scaffolding to allow her to make more progress.

Implications and Future Practice

Overall, for the five students with the least gains, I did not do enough to engage and support them in learning the academic terms. For the first two boys I could have paired them up with partners who were strong in Spanish. For the third boy I could have utilized an adult to keep him on task and provide support. The fourth boy might have ended up with a different partner. And for the fifth student, I should have checked in with her more and made sure that she knew what she was doing. She also might have benefited with working with a pair of strong learners in this study time. In terms of the capital that was in the room, I did not match this student with others who possess *navigational capital* or *linguistic capital* (Yosso, 2005). She was a recent arrival student who does speak Spanish, but for this work she did not have access to the content. In the same classroom others have gone through what this student was going through and could have been asked to help her out.

For all students, more explicit forms of studying needed to be explored. I could have capitalized on the two groups who were studying in a way that was testing the knowledge of the other partner. I could have shown the whole class a clip of this kind of studying and then had students practice it. We could have discussed the benefits of looking at the pictures and trying to recall the word to greater length. Another area of improvement would have been to ensure the completion and turning in of the vocabulary

index cards from all participants in this study. Several students did not turn in anything even though many of them were working on the index cards in class. The information and conclusions drawn from this study would have been more complete had this happened.

Finally if I were to continue working with these students, I would have utilized more vocabulary index cards to study more terms in different content areas and in English. The study skills that I was trying to promote are not isolated to one subject or one unit of study. They are skills that become increasingly important as students transition into middle school and beyond. I chose to focus this action research on learning academic Spanish, but I hope the students can see how these skills transfer to all content areas and in any language.

Conclusion

This study explored how students' academic Spanish would be promoted by the implementation of vocabulary index cards. The content area was science within a dual language school comprised of Spanish and English native speakers. The fifth-graders in this study all showed improvement in their ability to use more academic Spanish as measured by the point gains made on the vocabulary posttest. The level of detail toward making the vocabulary index cards varied greatly among the participants, but female students scored higher based on rubric scores. Also more female students spoke in a presentation and more female students completed their vocabulary index cards. Overall the greatest gains were made by female students within this class. Two pairs of two students in a smaller study group showed great strategies in studying their vocabulary index cards and all four students did remarkably well on the posttest, with three of the

four achieving a perfect score. Had I taught the rest of the class their strategies more explicitly, maybe more students would have studied more productively. Finally, I failed to reach five students through this project. I did not provide enough accommodations or scaffolds for them to access the information. I did not make considerations for the pairing of these students during study time, nor did I do enough checking in with them to verify their progress on the creation of the vocabulary index cards. I could have served these students better.

Overall the implementation of the vocabulary index cards was a success, as was the teaching of the science unit in Spanish. Students seemed engaged in the science lessons and worked well with each other. Spanish was being used consistently during science time and academic terms explored and used throughout the four weeks of instruction. I finished this research with a sense of pride in the efforts of the students. I felt good about my first experience of teaching in Spanish. Also I felt that students could take away with them one way to systematically study new terms and a way to become more academically bilingual. Bilingual education has been well documented in its power of giving voice to students who are learning English. I wanted to give all students more incentive to focus their energy on learning academic Spanish. Vocabulary index cards are merely one means of accomplishing this end.

References

- Alanís, I., & Rodríguez, M. A. (2008). Sustaining a dual language immersion program: Features of success. *Journals of Latinos and Education, 7*(4), 305-319.
- Alfaro, E. C., Umaña-Taylor, A. J., & Bámaca, M. Y. (2006). The influence of academic support on Latino adolescents' academic motivation. *National Council on Family Relations, 55*(3), 279-291.
- Auerbach, C., & Silverstein, L. B. (2003). *Qualitative Data: An Introduction to Coding and Analysis*. New York, NY: NYU Press.
- Carlo, M. S., August, D., Mclaughlin, B., Snow, B., Dressler, C., Lippman, D., . . . White, C. E. (2004). Closing the gap: Addressing the vocabulary needs of English-language learners in bilingual and mainstream classrooms. *Reading Research Quarterly, 39*(2), 188-215.
- Carrigo, D. (2000). *Just how much English are they using? Teacher and student language distribution patterns, between Spanish and English, in upper-grade, two-way immersion Spanish classes*. Unpublished doctoral dissertation, Harvard University, Cambridge, MA.
- Chamot, A. U., & O'malley, J. M. (1987). The cognitive academic language learning approach: A bridge to the mainstream. *TESOL quarterly, 21*(2), 227-249.
- Christian, D. (1996). Two-way immersion education: Students learning through two languages. *The Modern Language Journal, 80*(1), 66-76.
- Cummins, J. (1999). Alternative paradigms in bilingual education research: Does theory have a place? *Educational Researcher, 28*(7), 26-41.
- Cummins, J. (2005). Teaching for cross-language transfer in dual language education: Possibilities and pitfalls. *TESOL Symposium* 1-18.

- Hammer, C. E., Jia, G., & Uchikoshi, Y. (2011). Language and literacy development of dual language learners growing up in the United States: A call for research. *Child Development Perspectives, 5*(1), 4-9.
- Hispanic Population: Census Information. (2013). *Profile America Facts for Features*. Retrieved from https://www.census.gov/newsroom/releases/archives/facts_for_features_special_editions/cb13-ff19.html
- Howard, E. R. & Christian, D. (2002). Two-way immersion 101: Designing and implementing a two-way immersion education program at the elementary level. *Center for Research on Education, Diversity, and Excellence, 1-25*.
- Honig, S. (2012). Teaching science, teaching language. *Illinois Reading Council Journal, 40*(3), 32-39.
- Krashen, S., & McField, G. (2005). What works? Reviewing the latest evidence on bilingual education *Language Learners*, Nov. Dec. 7-10.
- Lagarreta, D. (1977). Language choice in bilingual classrooms. *Teachers of English to Speakers of Other Languages Quarterly, 11*(1), 9-16.
- Lindholm-Leary, K. (2007). Dual Language Education. *In the Starlight 4*, 1-4.
- Marzano, R. J. (2009). Six steps to better vocabulary instruction. *The Art and Science of Teaching, 83-84*.
- Mason, H. (2003). Does bilingual education translate to success? *Minority Rights and Relations, 43-44*.

- Mertens, D. M. (2009). *Research and Evaluation in Education and Psychology: Integrating Diversity with Quantitative, Qualitative, and Mixed Methods* (Third edition). Los Angeles: SAGE Publications, Inc.
- Moll, L. C., Amanti, C., Neff, D., & Gonzalez, N. (1992). Funds of knowledge for teaching: Using a qualitative approach to connect homes and classrooms. *Theory Into Practice, 31*(2), 132-140.
- Washington State Report Card. (2015). Olympia, WA: Office of the Superintendent of Public Instruction. Retrieved from <http://reportcard.ospi.k12.wa.us/summary.aspx?groupLevel=District&schoolId=1&reportLevel=State&year=2013-14>
- Pease-Alvarez, L., & Winsler, A. (1994). Cuando el maestro no habla Español: Children's bilingual language practices in the classroom. *TESOL Quarterly, 28*(3), 507-535.
- Potowski, K. (2004). Student Spanish use and investment in a dual immersion classroom: Implications for second language acquisition and heritage language maintenance. *The Modern Language Journal, 88*(i), 75-101.
- Potowski, K. (2007). Characteristics of the Spanish grammar and sociolinguistic proficiency of dual immersion graduates. *Spanish in Context, 4*(2), 187-216.
- Potowski, K., Berne, J., Clark, A., & Hammerand, A. (2008). Spanish for K-8 heritage speakers: A standards-based curriculum project. *Hispania, 91*(1), 25-41.
- Pries, C. H., & Hughes, J. (2012). Inquiring into familiar objects: An inquiry-based approach to introduce scientific vocabulary. *Science Activities, 49*: 64-69.

- Proctor, P., & Mo, E. (2009). The relationship between cognate awareness and English comprehension among Spanish-English bilingual fourth grade students. *Teachers of English to Speakers of Other Languages (TESOL)*, 43(1), 126-136.
- Rolstad, K., Mahoney, K., & Glass, G.V. (2005). The big picture; A meta-analysis of program effectiveness research on English language learners. *Educational Policy*, 19(4), 572-594.
- Schmitt, N., & Schmitt, D. (1995). Vocabulary notebooks: Theoretical underpinnings and practical suggestions. *ELT Journal*, 40(2), 133-143.
- Swinney, R., & Velasco, P. (2011). *Connecting content and academic language for English learners and struggling students grades 2-6*. Thousand Oaks, CA: Corwin.
- Walters, J., & Bozkurt, N. (2009). The effect of keeping vocabulary notebooks on vocabulary acquisition. *Language Teaching Research*, 13(4), 403-423.
- Yosso, T.J. (2005). Whose culture has capital? A critical race theory discussion of community cultural wealth. *Race Ethnicity and Education*, 8(1), 69-91.
- Zwiers, J. (2008). *Building academic language: Essential practices for content classrooms, grades 5-12*. San Francisco, CA: Jossey-Bass.

APPENDIX A

Vocabulary Terms and Definitions in Spanish

Atmósfera- se extiende hacia arriba por varios cientos kilómetros desde la superficie de la Tierra.

Biosfera- es donde se encuentran todos los seres vivos incluyendo, plantas, animales, protistas, hongos y bacterias.

Geosfera- generalmente se extiende desde la superficie de Tierra hasta su núcleo incluyendo todas las rocas, rocas fundidas, sedimentos, y suelos.

Hidrosfera- incluye océano, ríos, lagos, corrientes, agua subterránea y vapor de agua.

Seres Vivientes (Biótico)- tiene la capacidad de nacer, nutrirse, pueden reproducirse y morir.

Cosas no vivientes (Objetos Inertes o Abiótico)- No tiene vida como el agua, el sol, el suelo y el aire.

Terrario- habitat encerrado que puede consistir de plantas, insectos, y animales.

Observar- Mirar con atención y detalle a algo o un fenómeno.

Medir- Tomar el tamaño, cantidad, peso, o forma de algo.

Experimento- Una investigación o prueba para ver el resultado de un cambio a otra cosa.

Hipótesis- Suposición sin pruebas de que va a pasar en un experimento científico.

Variable Manipulada- En un experimento es la parte que se puede cambiar para ver el resultado de otra variable.

Variable Respondiente- En un experimento es la cantidad o condición que se cambia como resultado de otra variable.

Ciclo del agua- El movimiento constante del agua de nuestro planeta.

Precipitación- Agua que cae a la tierra en la forma de lluvia, nieve, o granizo.

Condensación- El vapor de agua formándose en nubes.

Evaporación- Agua que cambia de líquido a gaseoso por el calentamiento del sol.

Infiltración- Agua que entra a la tierra y pasa por debajo de la tierra.

Escorrentía- (Runoff) Agua moviendo en la superficie hasta un río, un lago, o el océano.

Cuenca- depresión en la superficie de la tierra que drena sus aguas a un lugar como un río, un lago, o el océano

APPENDIX B

Grading Rubric for Science Vocabulary Index Cards

Student Name: _____

Student number: _____

Science Vocabulary Index Cards Rubric			
Category:	3	2	1
Completeness	Finished all 20 notecards	Finished at least 17 of the notecards	Finished at least 12 of the notecards
Attractiveness and Organization	The notecards are really attractive and well-organized.	The notecards are somewhat attractive and well-organized.	The notecards are mostly disorganized and messy.
Picture	The pictures all represent the word and some may include color.	Most of the pictures represent the word, but may not include detail.	Pictures do not represent the word and lack detail.
Sentence Creation	Sentences are thoughtful and show creativity and understanding of the word.	Sentences are basic, but still show understanding of the word.	Sentences are incomplete or do not show an understanding of the word.

Student Score: _____ out of 12